

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Currently amended): A single type of semiconductor wafer cleaning apparatus comprising:

a rotary wafer chuck on which a wafer is to be mounted and rotated;

~~a de-ionized water supply means for supplying de-ionized water onto the wafer to form a layer of water on the wafer;~~

a gas spraying unit disposed above said wafer chuck, said gas spraying unit including a gas injection tube oriented to inject gas towards a wafer mounted to the chuck, and a gas guard connected to the gas injection tube, said gas guard defining a chamber having an open bottom adjacent the rotary chuck;

de-ionized water supply means for supplying de-ionized water onto a wafer at a location outside said chamber when the wafer is mounted to the chuck, to thereby provide a layer of de-ionized water on the wafer; and

gas supply means [[,]] for supplying gases [[, connected]] to the gas injection tube such that the gases issue from the tube and are confined by said chamber to thereby reduce the thickness of the layer of de-ionized water provided by the de-

ionized water supply means on the wafer, whereby diffusion of the gases into the layer of water is facilitated on the wafer.

Claim 2 (Original): The apparatus of claim 1, and further comprising an X-Y drive mechanism connected to said gas spraying unit such that the gas spraying unit can be moved forward and backward and to the right and to the left relative to an upper surface of a wafer mounted to the chuck.

Claim 3 (Original): The apparatus of claim 1, wherein said gas guard comprises a frusto-conical portion having upper and lower openings, the upper opening being smaller than the lower opening.

Claim 4 (Original): The apparatus of claim 1, wherein said gas guard has holes extending through a wall thereof that delimits said chamber.

Claim 5 (Original): The apparatus of claim 1, wherein said gas injection tube comprises a plurality of nozzles.

Claim 6 (Currently amended): The apparatus of claim 1, wherein the gas injection tube and the gas guard are formed of a material selected from the group consisting of [[Teflon[®]]] tetrafluoroethylene, stainless steel, gold, and platinum.

Claim 7 (Currently amended): The apparatus of claim 1, wherein the de-ionized water supplying means includes a plurality of de-ionized water supply lines each having an outlet disposed above said wafer chuck outside said chamber.

Claim 8 (Original): The apparatus of claim 1, wherein said gas supply means includes a plurality of sources of gas selected from the group consisting of ozone (O₃), hydrofluoric acid (HF), ammonia (NH₃), carbon dioxide (CO₂), sulfur oxide (SO₂), hydrogen (H₂), nitrogen (N₂), argon (Ar), isopropyl alcohol (IPA), and a combination of gases of the group.

Claim 9 (Original): The apparatus of claim 1, and further comprising a megasonic transducer attached to the gas spraying unit so as to transmit supersonic waves via the gas guard.

Claim 10 (Currently amended): The apparatus of claim 1, wherein the gas supply means includes a mixer for mixing a plurality of gases, said mixer being disposed upstream of said gas injection tube.

Claim 11. (Currently amended): A wafer cleaning apparatus comprising :

a rotary wafer chuck on which a wafer is to be mounted and rotated;

~~a source of de-ionized water, and at least one de-ionized water supply line extending from said source of de-ionized water to a location directly above an outer portion of said wafer chuck;~~

a gas spraying unit disposed above said wafer chuck, said gas spraying unit including a gas injection tube having an outlet oriented to inject gas towards a wafer mounted to the chuck, and an annular gas guard attached to and extending downwardly from said gas injection tube, said annular gas guard defining a chamber beneath the outlet of said gas injection tube, the chamber having an open bottom;

a source of de-ionized water, and at least one de-ionized water supply line extending from said source of de-ionized water to a location outside said chamber and directly above an outer peripheral portion of said wafer chuck, to thereby provide a layer of de-ionized water on the wafer; and

a source of cleaning gas connected to said gas injection tube such that the gas issues from the tube and is confined by said chamber to thereby reduce the thickness of the layer of de-ionized water provided on the wafer, whereby diffusion of the gases into the layer of water is facilitated on the wafer.

Claim 12 (Original): The apparatus of claim 11, and further comprising a drive mechanism that moves said gas spraying unit relative to a wafer mounted to said chuck relative to one another in a plane parallel to an upper surface of the wafer, whereby the upper surface of the wafer can be scanned with gas issuing from the gas injection tube of said gas spraying unit.

Claim 13 (Currently amended): The apparatus of claim 11, wherein said gas guard comprises a frusto-conical portion having upper and lower openings, the upper opening being smaller than the lower opening.

Claim 14 (Original): The apparatus of claim 11, wherein said gas guard has holes extending through a wall thereof that delimits said chamber.

Claim 15 (Original): The apparatus of claim 11, wherein said gas injection tube comprises a plurality of nozzles, and said source of cleaning gas is connected to at least one of said nozzles.

Claim 16 (Original): The apparatus of claim 15, and further comprising a source of isopropyl alcohol connected to one of said nozzles, whereby a wafer mounted to said rotary chuck can be dried.

Claim 17 (Original): The apparatus of claim 15, wherein said cleaning gas includes at least one gas selected from the group consisting of ozone (O₃), hydrofluoric acid (HF), ammonia (NH₃), carbon dioxide (CO₂), sulfur oxide (SO₂), hydrogen (H₂), nitrogen (N₂), argon (Ar), isopropyl alcohol (IPA).

Claim 18 (Currently amended): The apparatus of claim ~~1~~ 11, and further comprising a megasonic transducer attached to the gas spraying unit so as to transmit supersonic waves via the gas guard.

Claims 19 – 25 (Cancelled).

Claim 26 (New): A single type of semiconductor wafer cleaning apparatus comprising:

a rotary wafer chuck on which a wafer is to be mounted and rotated;
de-ionized water supply means for supplying de-ionized water onto the wafer to form a layer of water on the wafer;

a gas spraying unit disposed above said wafer chuck, said gas spraying unit including a gas injection tube oriented to inject gas towards a wafer mounted to the chuck, and a gas guard connected to the gas injection tube, said gas guard defining a chamber having an open bottom adjacent the rotary chuck, and said gas guard having holes extending through a wall thereof that delimits said chamber; and

gas supply means for supplying gas to the gas injection tube.

Claim 27 (New): A single type of semiconductor wafer cleaning apparatus comprising:

a rotary wafer chuck on which a wafer is to be mounted and rotated;
de-ionized water supply means for supplying de-ionized water onto the wafer to form a layer of water on the wafer;

a gas spraying unit disposed above said wafer chuck, said gas spraying unit including a gas injection tube oriented to inject gas towards a wafer mounted to the

chuck, and a gas guard connected to the gas injection tube, said gas guard defining a chamber having an open bottom adjacent the rotary chuck;

a megasonic transducer attached to the gas spraying unit so as to transmit supersonic waves via the gas guard; and

gas supply means for supplying gases to the gas injection tube.